EVALUATING THE IMPORTANCE OF ROADSIDE HABITAT FOR NATIVE INSECT POLLINATORS

Progress Report #1

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To:

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BACKGROUND AND NEED

Pollinators are essential to global food security. The ecological service provided by the hundreds of species of wild bees, birds, and other wildlife, primarily insects, is necessary for the reproduction of some 75% of all flowering plants on earth. This includes the vast majority of the fruit, vegetable, seed crops that humans consume, as well as many other crops that provide fiber, animal forage, medicine, and fuel. In the United States, the economic value of native or wild insect species responsible for pollinating is over $3 billion in crops.

Beyond the direct economic value to humans, insect pollination provides essential maintenance of the structure and function of a wide range of natural communities in North America. It sustains native and introduced plants that control erosion, provide food and other resources for game and non-game wildlife, increase property values, and enhance the aesthetic, recreational, and cultural aspects of human activity.

Continued declines in pollinator activity could adversely affect the availability, price, and quality of the many fruits, vegetables and other products, result in increased vulnerability of some plant species to extinction, and cause overall ecosystem disruption. The 2008 Farm Bill specifically identifies pollinators and their habitat as a key priority for every USDA land manager and conservationist. Habitat degradation and loss is one of the leading factors driving the downward trend of pollinator populations. Fortunately, there are a number of relatively simple and inexpensive measures that can be taken to enhance pollinator populations, many of which can be effectively integrated with other conservation initiatives already designed to protect soil, water and air quality, and enhance wildlife habitat or public well being. While much recent attention has been placed on alternative management approaches on agricultural lands to enhance pollinator resources, it is clear that effective pollinator population conservation must incorporate a larger landscape, with overall efforts involving habitats well outside of the basic farm margin.

The Florida Department of Transportation is responsible for management and care of 186,000 acres; ½ of one percent (one of every 200 acres) of the entire land area of Florida. Unlike a contiguous parcel of this size, state highway roadsides are a network of living edges, touching and linking nearly every natural and agricultural resource in the state. The impact of roadside management decisions extends far beyond the road's edge, often for several hundred yards, and impacts nearly twenty times that amount of the surrounding environment. Naturally, roadsides support a wide variety of pollen and nectar resources; and unlike agricultural landscapes, remain unplowed, and therefore can provide potential nesting sites for ground nesting bees. These same roadsides border or bisect much of the 9.25 million acres or so of commercial agricultural lands in Florida responsible for contributing billions of dollars to the state's economy each year.

By investigating how roadside vegetation management helps support and benefit pollinator populations, the proposed project directly supports the Florida Department of Transportation's (FDOT) overall mission of enhancing economic prosperity and preserving the quality of the state's environment and communities. It further strengthens alliances with the Florida Department of Agriculture and Consumer Services by assisting Florida's farmers and agricultural industries and helping to conserve and protect the state's agricultural and natural resources.

SCOPE OF WORK

Study 1: The effect of roadside margin mowing regime on native pollinator richness and abundance.

Methods- Treatment Specifications:

A minimum of three (3) roadways in north-central Florida will be selected for use in the study. Similar road types will be used, all with the same posted speed limit, similar traffic volumes, similar adjacent habitat type, and lane number. Roadside blocks of habitat will be identified. Each block will consist of a 600-m-strip of margin parallel to one side of the road, within which each of three treatments is administered in 200-m-sections. All blocks within each site will be on the same side of the road. There will be a 100-m-buffer between each block. The treatments are no mowing (Treatment A) during the course of the study, mowing every 42 days (Treatment B), and mowing every 21 days (Treatment C, standard practice) (Fig 1). The mowing treatments will be administered by the Florida Department of Transportation (FDOT). The three treatments will be randomly assigned within each block (Fig 2) using a random number generator.

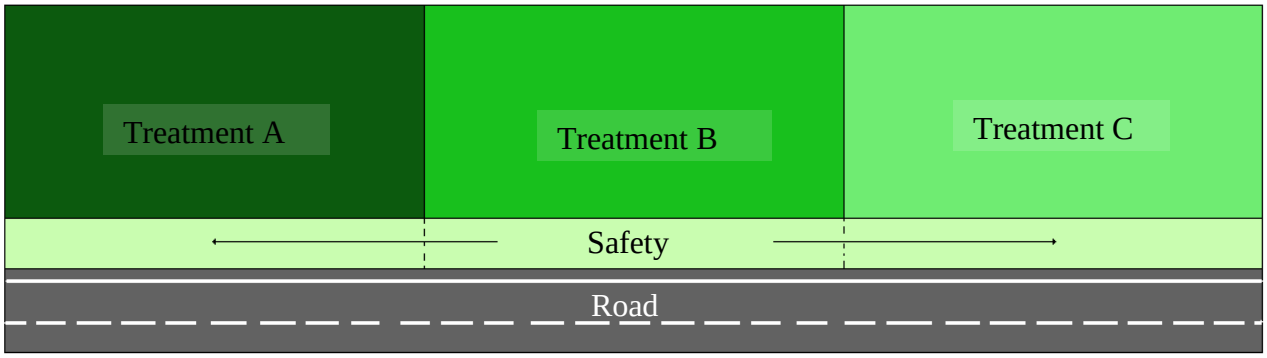

Figure 1. Hypothetical mowing regime schematic for a block. Treatment A= no mow, Treatment B= mowing every 42 days, and Treatment C= mowing every 21 days (standard practice). The safety strip is mowed as often as necessary. An entire block is 600 m long and each treatment is 200 m long. The schematic's width is not to scale.

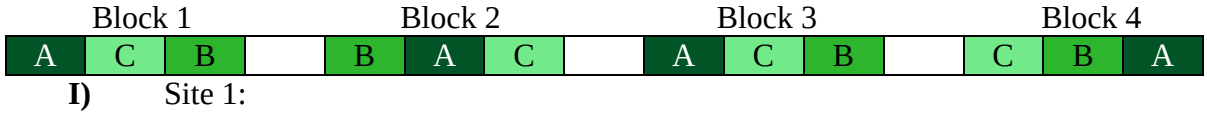

Figure 2. Mowing treatment randomization pattern to be implemented throughout the course of the study. The white spaces are the 100 m buffers between blocks, with the next block continuing after the buffer. The exact configuration of each roadway site will determine the number of treatment blocks assigned.

The first 3 m along the road's immediate edge, i.e. safety strip, will be mowed independently from the treatments. This is the width considered necessary to allow space for a vehicle to safely pull off the paved surface of the road. Its mowing frequency will likely depend on the growth rate of the vegetation, which will need to be maintained at a fairly short height. The remaining margin that goes back to the established woody vegetation will receive the mowing treatments.

Permanent signs demarcating the randomization assignments will be placed at the margin-woody vegetation line by the FDOT at the beginning and end of each 200 m treatment section within each block. The signs read: "A, B, C" or "Buffer". The FDOT will inform its workers what the letters designate and they will be made aware of the mowing specifications. Each site will also have a larger sign to notify the public about the experiment (suggested language for informative signs such as FDOT and University of Florida Pollinator Research Study).

Insect Pollinator Sampling:

The project will focus on sampling the species richness and abundance of native bees and butterflies. For native bees, two sampling methods will be employed concurrently: and traditional hand collecting and pan trapping.

Diagonal transects will be established in each treatment plot. Hand collections of bees on flowers will be made using vials and jars. Netting will be avoided to prevent damage to surrounding vegetation and floral resources. In particular, sweep net sampling can severely damage vegetation and might subsequently influence its species composition. Hand collecting will be conducted by slowly walking the transect line for a period of 5 minutes, examining plants for bees and collecting any bees observed. Sampling will be conducted once every two-four weeks during the study. Two sampling periods (between 8am-noon and 1pm and 5pm) will be conducted on survey days. The date, time, block number, treatment, and flower species on which it was collected will be recorded for each insect.

To correct for a potential sampling bias by hand collecting, pan traps will also be used. Pan traps are small brightly colored plastic bowels (filled with water and a drop of detergent as a surfactant) used to passively sample bee species in natural and agricultural communities. We will use pan traps in three colors (yellow, white and blue) to passively survey the roadside plots. Pan trapping has important advantages compared to more traditional bee collection methods. It can eliminate collector bias, which is particularly important when comparing data across different studies or when using multiple collectors in the same study, and it can be easily replicated for consistent sampling intensity by collectors with minimal training at multiple sites. Pan traps eliminate collector bias, are relatively inexpensive, are easily replicated, and can be used over a longer period of time at multiple sites simultaneously. This method is particularly effective at collecting numerous species of bees, but can also be effective at collecting various flower-visiting flies, skipper butterflies, and a range of other insect taxa. To effectively enumerate the bee diversity of a particular location, a range of pan trap colors must be employed. Pan traps will be used to help determine whether additional pollinator species were present that were not being collected on flowers. Sets (one of each color) of pan traps will be employed every two -four weeks during the study concurrently with hand collecting periods. All traps will remain in the field for 24hrs. At the end of the sampling period, pan trap contents will be strained, washed,

dried, and pinned for identification. The date, block number, treatment, and pan color in which it was collected will be recorded for each insect.

All bees will be identified to at least the genus level.

Living butterflies will be counted visually every 2 weeks by walking a transect passing through the center of the treatment margins and running parallel to the road. The field of vision of the observer will roughly span the width of the margin and be roughly 2 m out ahead of the observer. The observer will walk at a reasonable pace and record butterfly species on a field data sheet. Surveys will be conducted during the hours of peak butterfly activity (10am-4pm). Since most butterfly species have an average life span of 2-4weeks as adults, the 2 week sampling interval is appropriate.

Floral Sampling:

Floral diversity and abundance in the roadside margin will be assessed monthly. Each treatment block will be divided into 30 equal sized units (Fig. 3). During each sampling period, 10 units will be randomly selected. In each unit, a 1 m^2 PVC quadrat will be haphazardly placed. The number of open flowers of each species will be counted per quadrat (even if stem originates outside quadrat) and the average height of the vegetation will be measured using a calibrated pole.

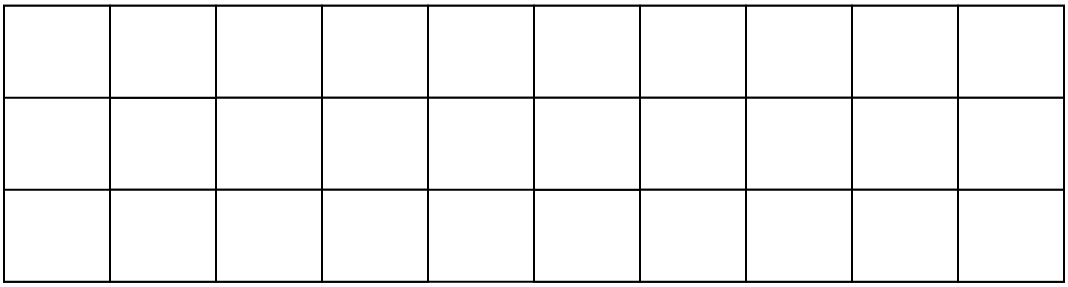

Figure 3. Treatment block showing 30 equally sized unit divisions for vegetative sampling trails.

Digital photographs of each treatment block will be taken every month from a set point to track the overall condition of the vegetation.

Study 2: The effect of roadside wildflower augmentation on native pollinator richness and abundance.

The methods of insect and vegetation sampling will follow the previous study with the exception of block treatment (fig.1) and block length.

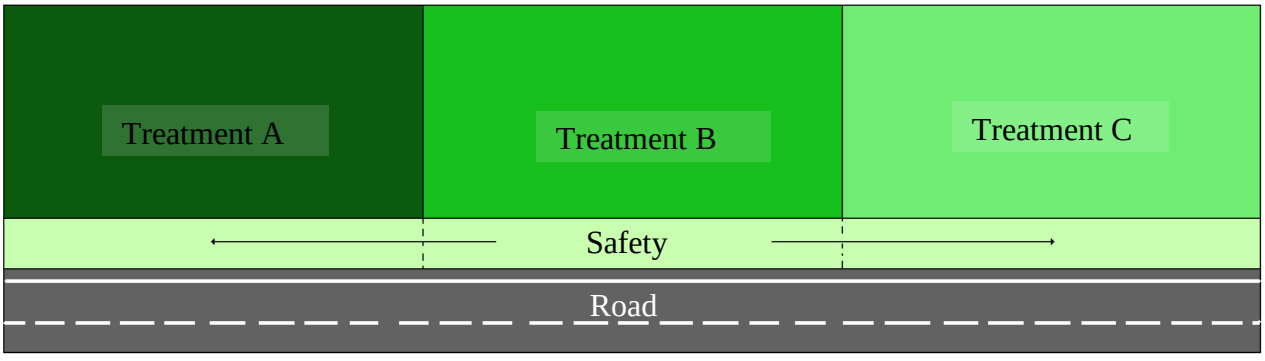

Figure 4. Hypothetical wildflower planting regime schematic for a treatment block. Treatment A= no augmentation/natural vegetation, Treatment B= basic diversity wildflower mix (2-3 species), and Treatment C= high diversity wildflower mix (4-5 species). The safety strip is mowed as often as necessary. The wildflower species utilized and block a treatment length will be determined in collaboration with FDOT.

WORK COMPLETED TO DATE

Project inception – December 31, 2011

Project Staff: FDOT support provides funding for a Postdoctoral Research Associate to assist with the overall project development and implementation. An appropriate job description in the area of Pollination Ecology was developed and posted on the University of Florida Job Site (https://jobs.ufl.edu/). Over 20 applicants were received and a total of 4 candidates were interviewed via phone. A final candidate was identified and accepted the offer. As this person was an Ecuadorian citizen, it necessitated securing an H1-A visa. I have worked with our University of Florida Department of Human Resources to expedite the visa paperwork and processing. Despite expediting the paperwork, a delay was encountered with processing and thus the individual will not be able to start until March 2012. I have subsequently initiated the process of hiring an OPS employee to assist with the project.

Site Identification: In collaboration with the FDOT maintenance departments in Lake City and Gainesville, all field trial sites have been identified for Study Component 1: The effect of roadside margin mowing regime on native pollinator richness and abundance. These consist of primarily rural highways or roadways adjacent to agricultural or conservation lands. We worked with FDOT in Gainesville to delineate the repeated bloc design and mowing regimes. All sites and blocks have associated signs designating the mowing frequency. FDOT initiated the recommended mowing during the fall as a trial. In January and February, we will delineate all trial plots with the Lake City office.

FDOT in Gainesville has agreed to assist with Study Component 2: The effect of roadside wildflower augmentation on native pollinator richness and abundance. We have identified target wildflower species (*Chamaecrista fasciculata, Gaillardia pulchella, Rudbeckia hirta, and Coreposis lanceolata*). These species are readily available, appropriate for the trial locations and meet the appropriate cost requirements associated with FDOT planting and this study. Two seed quotes have been secured and the seed will be ordered in January and provided to FDOT for soon after for immediate planting. We have requested that the seed be planted using normal FDOT methods.

Pollinator and vegetation surveys are scheduled to begin for Project Component 1 sites in late February and continue through October in each of the project years. Pollinator and vegetation surveys are scheduled to begin for Project Component 2 sites as soon as flowering is recorded of augmented plots.